# South Central Regional Chapter

*The Junction of Environmental Science and Society*

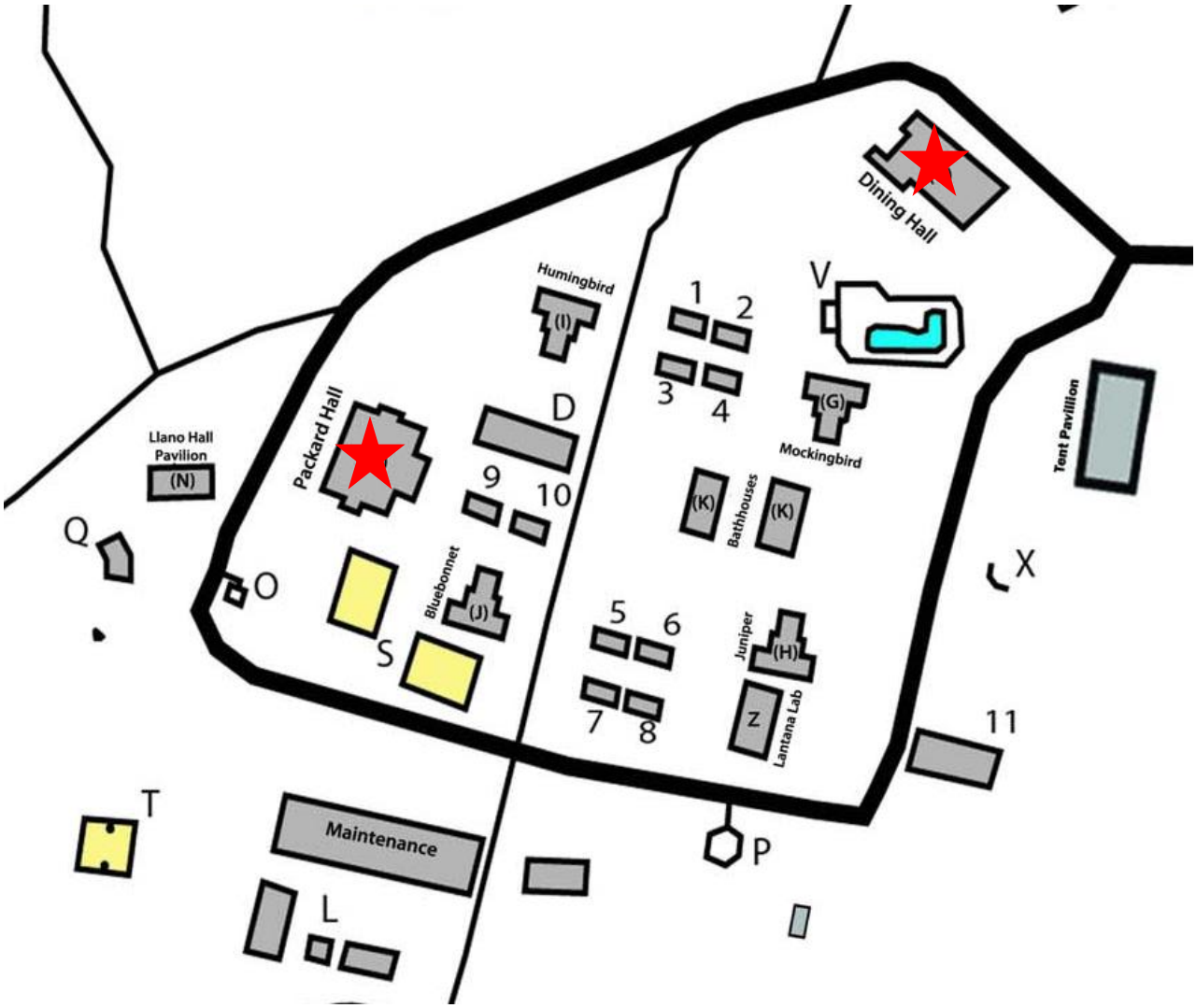
## Annual Spring Meeting

## Texas Tech University - Junction

## April 26 – 28, 2018

# Program and Abstract Book

**Presentations and Posters will be in Packard Hall.**
**Meals will be in the Dining Hall.**



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# SETAC – South Central Regional Chapter

# 2018 Spring Meeting Schedule

## *Thursday, April 26*

2:00 pm – 5:00 pm — Registration and Room Check-In
Packard Hall Classroom

6:00 pm – TBD — Dinner on your own; informal social time

## *Friday, April 27*

7:30 am – 8:30 am — Breakfast
Dining Hall

8:30 am – 8:45 am — Poster Set-Up
Packard Hall Classroom

8:45 am – 9:00 am — Welcome
Packard Hall Classroom

9:00 am – 10:20 am — Platform Session I
**Chair:** Jordan Crago

9:00 **Marco Franco,** G.E. Sutherland, R. Lavado
*Xenobiotic Metabolism in the Fish Hepatic Cell Lines Hepa-E1 and RTH-149, and the Gill Cell Lines RTgill-W1 and G1B: Biomarkers of CYP450 Activity and Oxidative Stress*

9:20 **Kelsey N. Thompson,** C.N. Ryan, J.E. Wilkinson, C.D. Phillips, G.D. Mayer
*Remediation Check: Bacterial Community Structures in Sediment and Megafauna at the Callahan Mine Site in Brookville Maine, during the Operational Unit 1 Clean-up Phase.*

9:40 **Kristin Bridges,** Y. Zhang, T.E. Curran, J.T. Magnuson, K.E. Durrer, M.S. Allen, B.J. Venables, A.P. Roberts
*Alterations to the Intestinal Microbiome and Metabolome of Pimephales promelas and Mus musculus Following Exposure to Dietary Methylmercury.*

10:00 **Brittany L. Harried,** D.J. Daugherty, D. Neeley, T.M. Sutton, B.K. Soulen, D. Kim, A. Melton, M. Rubiano, A.P. Roberts, D.J. Hoeinghaus
*Mercury Body Burden and Maternal Transfer, Egg Quality and Fecundity of Alligator Gar in the Lower Trinity River: Are Bigger Fish Always Better for Recruitment?*

10:20 am – 10:50 am — Break/Posters

10:50 am – 11:50 am Plenary Session
**Chair:** Todd Anderson

***Novel Insights into Crude Oil and PAH Toxicity to Teleost Fishes?***
Dr. Ed Mager
Department of Biological Sciences
University of North Texas
Edward.Mager@unt.edu

***Zebrafish in Environmental Research: Linking Molecular Pathways, Physiological Changes and Behavior to Environmental Contaminants***
Dr. Jordan Crago
Department of Environmental Toxicology
Texas Tech University
jordan.crago@ttu.edu

***Bioanalytical Tools for Advancing in Environmental Quality Assessment***
Dr. Ramon Lavado
Department of Environmental Sciences
Baylor University
ramon.lavado@baylor.edu

12:00 pm – 1:00 pm Lunch
Dining Hall

1:15 pm – 2:00 pm Poster Session
Packard Hall Classroom

2:05 pm – 3:25 pm Platform Session II
**Chair:** Jordan Crago

2:05 **Jason T. Magnuson,** A. Khursigara, E. Allmon, A. Esbaugh, J. Stieglitz, R. Heuer, M. Grosell, A.P. Roberts
*Early Life Stage Fishes Exposed to Crude Oil have Reduced Visual Function*

2:25 **Mallory Seemann**, P. Bruns, M.K. Jeffries
*Identifying the Causes of Reproductive Impairment Following Thyroid Disruption*

2:45 **Kyle Roush**, M.K. Jeffries
*Screening for Reproductive Endocrine Disrupting Compounds: Does Phenotype Influence Test Outcome?*

3:05 **Katelyn Haydett**, S.T. Peper, H.S. Greenberg, A.N. Wilson-Fallon, J.A. Gaskamp, S.L. Webb, S.M. Presley
*Seroprevalence of Neospora caninum in Wild Pigs (Sus scrofa).*

3:25 pm – 3:50 pm Break/Posters

3:50 pm – 5:10 pm — Platform Session III
**Chair:** Jordan Crago

3:50 **Benjamin T. Castellon**, B.G. Perrotta, M. Simonin, S.M. Anderson, E.S. Bernhardt, R.S. King, C.W. Matson
*Accumulation and Depuration of Metallic Nanoparticles in Replicated Outdoor Wetland Mesocosms in Gambusia holbrooki and Corbicula fluminea*

4:10 **Olushola M. Awoyemi**, J. Crago
*An Investigation into the Behavioral, Molecular, and Physiological Responses of Embryo-Larval Zebrafish Exposed to Types I and II Pyrethroids*

4:30 **Naveen Kumar**, J. Crago
*An Investigation of Off-Target Toxicity at Environmentally Relevant Concentrations of Fungicides Using an Embryo-Larval Zebrafish (Danio rerio) as a Model*

4:50 **Katherine M. Martin**, E.A. Hasenmueller, J.R. White, L.G. Chambers, J.L. Conkle
*Assessing Microplastics in the Mississippi River Watershed and Their Discharge to the Gulf of Mexico*

5:10 pm – 5:30 pm — Poster Session
Packard Hall Classroom

5:30 pm – 6:30 pm — Dinner
Dining Hall

6:30 pm – TBD — Informal Social

## *Saturday, April 28*

8:30 am – 9:30 am — Breakfast
Dining Hall

9:30 am – 10:30 am — South Central Chapter Business Meeting
Packard Hall Classroom

Student Chapters Meeting
Packard Hall Classroom

# Abstracts

***Platform 1***

Marco Franco, G. E. Sutherland, R. Lavado
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**Xenobiotic metabolism in the fish hepatic cell lines Hepa-E1 and RTH-149, and the gill cell lines RTgill-W1 and G1B: biomarkers of CYP450 activity and oxidative stress.** The use of fish cell cultures has proven to be an effective tool in the study of environmental and aquatic toxicology. Valuable information can be obtained from comparisons between cell lines from different species and organs. In the present study, specific chemicals were used and biomarkers (e.g. 7-Ethoxyresorufin-*O*-deethylase (EROD) activity and reactive oxygen species (ROS)) were measured to assess the metabolic capabilities and cytotoxicity of the fish hepatic cell lines Hepa-E1 and RTH-149, and the fish gill cell lines RTgill-W1 and G1B. These cell lines were exposed to β-naphthoflavone (BNF) and benzo[*a*]pyrene (BaP), the pharmaceutical tamoxifen (TMX), and the organic peroxide tert-butylhydroperoxide (*t*BHP). Cytotoxicity in gill cell lines was significantly higher than in hepatic cells, with BNF and TMX being the most toxic compounds. CYP1-like associated activity, measured through EROD activity, was only detected in hepatic cells; Hepa-E1 cells showed the highest activity after exposure to both BNF and BaP. Significantly higher levels of CYP3A-like activity were also observed in Hepa-E1 cells exposed to TMX, while gill cell lines presented the lowest levels. Measurements of ROS and antioxidant enzymes indicated that peroxide levels were higher in gill cell lines in general. However, levels of superoxide were significantly higher in RTH-149 cells, where no distinctive increase of superoxide-related antioxidants was observed. The present study demonstrates the importance of selecting adequate cell lines in measuring specific metabolic parameters and provides strong evidence for the fish hepatocarcinoma Hepa-E1 cells to be an excellent alternative in assessing metabolism of xenobiotics, and in expanding the applicability of fish cell lines for *in vitro* studies.

***Platform 2***

Kelsey N. Thompson, C. N. Ryan, J. E. Wilkinson, C. D. Phillips, G. D. Mayer
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**Remediation Check: Bacterial Community Structures in Sediment and Megafauna at the Callahan Mine Site in Brookville Maine, during the Operational Unit 1 Clean-up Phase.** The Callahan Mine operated from the 1880s-1972, in Brooksville, Maine. After the closure of the mine the area was highly polluted by waste mine tailings. In 2001, the site was added to the National Priorities List under the auspices of the CERCLA, and in 2011 remediation of the site began. Studies from before the EPA's remediation of the area found elevated levels of several toxic metals in all media collected from Goose Pound Estuary. We collected samples of sediment and fish (*Fundulus heteroclitus*) gut microbiomes from Goose Pond Estuary in 2011, 2012, 2014 and 2015; during the remediation of the site. Remediation included removal of PCB contaminated soil to an offsite location or placement in tailings impoundments. We found that sediment samples collected closest to the tailings impoundment had a significantly different bacterial composition than the sediment samples

collected further down the tailings gradient and from a clean reference site (unweighted ADONIS, p = 0.001). The sediment samples had an increasingly high relative abundance of the genera *Dehalococcide*, a genus that obtains energy by oxidation of hydrogen, which leads to reductive dehalogenation of halogenated organic compounds. Thus, this genus of bacteria is known to remediate many anthropogenic compounds such as, PCE, TCE and PCBs. The gut microbiome samples collected from the site showed a loss in abundance of the phyla *Firmicutes* and *Proteobacteria* and an increase in the abundance of *Plantomycetes* and *Cyanobacterium*. These shifts could indicate unhealthy bacterial communities in the guts of our collected fish. Additionally, we qualitatively observed a decrease in overall abundance of fish at the mine site in 2015 and an increase in jellyfish. These data could indicate that remediation of the site is causing a disturbance of some of the settled pollutants in the estuary causing perturbation in the communities inhabiting the mine site.

***Platform 3***

Kristin Bridges, Y. Zhang, T. E. Curran, J. T. Magnuson, K. E. Durrer, M. S. Allen, B. J. Venables, A. P. Roberts
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**Alterations to the Intestinal Microbiome and Metabolome of *Pimephales promelas* and *Mus musc*ulus Following Exposure to Dietary Methylmercury.** Mercury is a globally distributed contaminant, which is found even in remote aquatic ecosystems as a result of atmospheric deposition. Methylmercury, resulting from microbial transformation of inorganic mercury, bioaccumulates and biomagnifies in biota, resulting in potentially toxic body burdens in long-lived organisms at the top of aquatic food webs. Methylmercury can be actively transferred from mother to offspring, with the potential to cause severe, irreversible effects on developing organisms. Here, we describe the developmental effects of exposure to maternally-transferred dietary MeHg on a model fish species (*Pimephales promelas*). Exposure to environmentally relevant concentrations of MeHg during development led to alterations in the dopaminergic system, metabolome, gene expression, behavior, hatch time, size, and embryo-larval survival. Similarly, effects on the dopaminergic system in specific regions of the adult *P. promelas* brain were observed after a 30-day dietary exposure. Recently, a functional link between gut microbiota and dopamine production in teleosts has been established. Therefore, we characterized MeHg-mediated changes to the gut microbiome composition in *P. promelas* adults. Because the dopaminergic system is highly conserved among taxa, we sought to confirm the altered dopamine concentrations in *P. promelas* brain in a higher vertebrate species. Metabolomics was performed on the mid-brains of male mice (*Mus musculus* CD-1) exposed to similar concentrations of dietary MeHg for 30-days. Changes in dopamine concentrations of the teleost brain were mirrored in the mid-brains of male mice, and several other significant changes to the mouse mid-brain metabolome were detected. Collectively, these results suggest current environmental exposure scenarios to MeHg are sufficient to induce a number of molecular-level changes that are associated with costs to whole organism fitness, with consequences for multiple life stages, and species. Due to the similar changes detected in mice, there is increasing evidence to suggest teleosts as a surrogate model species for studies assessing effects of MeHg on highly conserved systems.

***Platform 4***

Brittany L. Harried, D. J. Daugherty, D. Neeley, T. M. Sutton, B. K. Soulen, D. Kim, A. Melton, M. Rubiano, A. P. Roberts, D. J. Hoeinghaus
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**Mercury Body Burden and Maternal Transfer, Egg Quality and Fecundity of Alligator Gar in the Lower Trinity River: Are Bigger Fish Always Better for Recruitment?** Many factors can influence reproductive success of long-lived, periodic life-history strategists like Alligator Gar, *Atractosteus spatula*. Both egg quantity and quality are often positively related to maternal age and size for long-lived, large-bodied species. Thus, when considering management strategies, the largest individuals are often protected because of their assumed higher reproductive potential. Fish size and age are also positively related to environmental contaminant loading. Therefore, if larger, older fish have higher body burdens of contaminants that can negatively impact reproduction, we may need to consider trade-offs between reproductive potential and contaminant loading. We measured egg quantity and quality, mercury body burden, and maternal transfer among various sizes and ages of reproductively mature Alligator Gar collected from the lower Trinity River, Texas. Fecundity was positively correlated with body size, but egg lipid concentration was not significantly correlated with body size or fecundity. Total mercury (THg) in muscle and liver tissues significantly increased with body size, and egg THg increased with body size and liver THg. These results highlight the need for further research on the effects of contaminant loading for recruitment of Alligator Gar and potential re-evaluation of conservation and management strategies based primarily on reproductive potential.

***Platform 5***

Jason T. Magnuson, A. Khursigara, E. Allmon, A. Esbaugh, J. Stieglitz, R. Heuer, M. Grosell, A. P. Roberts
University of North Texas
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**Early Life Stage Fishes Exposed to Crude Oil have Reduced Visual Function.** Polycyclic aromatic hydrocarbons (PAHs) have been shown to cause developmental malformation in fishes, with effects greater during early life stages. Downregulation of genes important in eye development and function, as well as morphological abnormalities have resulted from exposure to PAHs present in *Deepwater Horizon* oil. Mahi-mahi, red drum, and sheepshead minnow embryos were exposed to weathered crude oil and assessed for visual function using the flicker-fusion principle to monitor an optomotor response, with subsequent histological analysis carried out of each larvae's retina. Oil-exposed larvae exhibited a reduced optomotor response with a reduction in retinal layers that play an important role in visual function and image processing. The present study relates oil-induced histological effects to behavioral endpoints and shows that weathered crude oil affects the visual system in early life stage fish. This research was made possible by a grant from The Gulf of Mexico Research Initiative.

***Platform 6***

Mallory Seemann, P. Bruns, M. K. Jeffries
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**Identifying the causes of reproductive impairment following thyroid disruption.** Some classes of endocrine disrupting compounds in the environment have the ability to alter thyroid function. Such thyroid disrupting compounds are known to influence growth and development, but recent studies suggest that thyroid disruption can also have adverse effects on reproduction. A recent study demonstrated that early-life stage thyroid disruption caused decreased reproductive output in fathead minnows (*Pimephales promelas*), even after a prolonged period of depuration. However, the mechanisms connecting early life stage thyroid disruption to altered reproduction during adulthood remain elusive. This study sought to determine whether alterations in reproductive success following thyroid disruption were a result of altered male or female reproductive performance. Larval fathead minnows less than 1 day post hatch were exposed to the model thyroid inhibitor propylthiouracil (PTU), and after a period of depuration, PTU-exposed and control fish were used in a breeding assay which utilized a factorial pair design of male and female fish. The results suggest that male exposure history, but not female exposure history, had a significant effect on fecundity and number of clutches produced, indicating thyroid inhibition of male fathead minnows drove the reduction in reproductive output. Because pairs containing male PTU-exposed fish do not spawn as frequently, it may be possible that thyroid inhibition during early development alters brain development in a way that leads to improper male sexual behavior. This hypothesis is supported by the fact that the expression of genes related to sex steroid signaling in the brains of the PTU-exposed fish during development were decreased compared to that of controls. Overall, the results of this study indicate that early-life stage thyroid disruption leads to alterations in male reproductive performance and that such alterations may result from altered patterns of sexual differentiation of the brain and subsequent changes in sexual behavior.

***Platform 7***

Kyle Roush, M. K. Jeffries
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**Screening for Reproductive Endocrine Disrupting Compounds: Does Phenotype Influence Test Outcome?** Reproductive endocrine disrupting compounds (REDCs) pose a threat to the health of humans and wildlife as they can alter sexual development, reduce reproductive output and alter behavior. Though several screening assays have been developed to assess the ability of chemicals to act as REDCs, evidence suggests that inherent biological variation in common endpoints of these assays (e.g., estrogen-responsive gene expression) may skew test results. Because secondary sexual characteristics (SSCs) are under the control of reproductive hormones, it was hypothesized that organisms that are similar to one another with regard to the prominence of SSCs (*i.e.*, similar phenotype) respond to REDC exposure with less variation than those that are dissimilar. As such, the goal of this project was to determine whether phenotypic differences in a model organism, the fathead

minnow (*Pimephales promelas*), can influence the ability to identify endocrine disrupting compounds. Specifically, we sought to determine whether phenotypically different minnows exposed to a suite of REDCs have different molecular responses following exposures to estrogenic and anti-estrogenic compounds. Sexually mature male and female minnows were sorted by the prominence of secondary sexual characteristics, exposed to an estrogen and anti-estrogen, respectively, for 7 days and sampled for the analysis of vitellogenin and estrogen receptor α expression. Results showed that fish with highly prominent secondary sexual characteristics responded differently to REDCs than fish with less prominent secondary sexual characteristics indicating that phenotype influences REDC exposure outcome. These findings can be used refine existing screening assays to ensure adequate detection of REDCs and their effects.

***Platform 8***

Katelyn M. Haydett, S. T. Peper, H. S. Greenberg, A. N. Wilson-Fallon, J. A. Gaskamp, S. L. Webb, S. M. Presley
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**Seroprevalence of *Neospora caninum* in Wild Pigs (*Sus scrofa*).** *Neospora caninum* is a protozoan parasite reported as a leading cause of cattle abortions and reproductive failure worldwide. After ingestion of infected tissues, definitive hosts such as coyotes and dogs excrete oocysts into the environment and can contaminate food and water sources available to livestock. Ingestion of *N. caninum* oocysts results in infection of cattle and other intermediate hosts. The parasite can then be vertically transmitted, resulting in spontaneous abortions, fetal reabsorption, and decreased milk production; costing the cattle industry approximately $1.3 billion dollars annually. With wild pig populations nearing 6 million in the United States, contact between wild pigs and livestock is inevitable. This is a result of an already widespread geographic distribution combined with continuous, rapid range expansion. As a known reservoir for numerous bacterial, viral, and parasitic diseases, wild pigs are of particular importance for public and veterinary health relative to the prevention of infectious diseases. Exposure to *N. caninum* in wild pig populations was first documented during 2013, raising the question as to their role in disease transmission. In collaboration with the Noble Research Institute, 388 wild pigs were captured in southern Oklahoma over approximately 11,000 acres during a three-year study. From this collection, 87 pigs were screened for *N. caninum* using a sandwich porcine *Neospora caninum* antibody ELISA Kit. Of those tested, a subsample was within the intraassay range and had a 66.1% seroprevalence. Those same 87 pig samples were re-tested using with a competitive inhibition *Neospora caninum* ELISA Kit and had a 1% seroprevalence. These results address a lack of consistent methodology and availability of controls when assessing disease prevalence in wild animal populations. This data also signifies the importance of continued disease surveillance in wild pigs to better understand the threat of environmental exposure and the role they play in disease transmission.

***Platform 9***

Benjamin T. Castellon, B. G. Perrotta, M. Simonin, S. M. Anderson, E. S. Bernhardt, R. S. King, C. W. Matson
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**Accumulation and Depuration of Metallic Nanoparticles in Replicated Outdoor Wetland Mesocosms in *Gambusia holbrooki* and *Corbicula fluminea*.** Engineered nanomaterials such as metallic nanoparticles (NPs) are ever more widely produced, used and released into surface waters, which may pose a risk to human and ecosystem health. While there is a growing body of research on the toxicity of NPs, risk assessments must account for the bioavailability of NPs at environmentally relevant exposure concentrations and in complex ecosystems. Here, we present results from a study in replicated outdoor wetland mesocosms exploring the bioavailability of gold (Au) NPs (11.8 nm) and cerium dioxide (CeO2) NPs of two sizes (small CeO2 NPs 3.8 nm, large CeO2 NPs 185.3 nm) in eastern mosquitofish, Gambusia holbrooki, and the invasive Asian clam, Corbicula fluminea. Fish were exposed to NPs in the mesocosms for either long-term and short-term durations, followed by depuration in clean water. Clams were only exposed for short-term durations. We quantified the accumulation of NPs in tissue homogenates using ICP-MS. Accumulation of NPs in fish was fast and mostly independent of NP size and exposure duration (peaking within 12-24 h). Nutrient additions, included as a covariate for Au NPs, was found to significantly increase the rate of Au NP accumulation, but only for short-term exposed fish. CeO2 NP depuration in fish is likewise fast and completed within 12 h for both CeO2 NPs at regardless of exposure duration. However, whereas short-term exposed fish were able to fully depurate Au NPs within 1 day, long-term exposed fish were found to only partially depurate Au NPs even after 7 days. Unlike observed for short-term exposures in fish, preliminary results in clams indicate that they only partially depurate Au NPs over a 7 day depuration period. Clams were also observed to accumulate much higher tissue concentrations of Au, relative to fish, during the short-term exposures.

***Platform 10***

Olushola M. Awoyemi, J. Crago
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**An Investigation into the Behavioral, Molecular, and Physiological Responses of Embryo-Larval Zebrafish Exposed to Types I and II Pyrethroids.** Pyrethroids are highly toxic to aquatic species. Most toxicity studies assess only single chemicals, which makes it difficult to assess relative toxicity across classes of pyrethroids. There are limited studies comparing the developmental toxicity of type I and II pyrethroids in aquatic systems at environmentally relevant concentrations. The goal of this study was to compare the behavioral, molecular and physiological effects of pyrethroid exposures in larval zebrafish (*Danio rerio*). Zebrafish were exposed to type I (bifenthrin, permethrin) and type II (lambda cyhalothrin, deltamethrin, esfenvalerate, fenvalerate) pyrethroids at 1000, 10, 0.1, 0.01 µg/L starting at 5 h post-fertilization (hpf) to 5 d post-fertilization (dpf). The stability of pyrethroids across the 5 days was analyzed using GC-MS. Gene expression and enzymatic assays were measured to

assess relative toxicity amongst the pyrethroids. Behavior assays assessing swimming behavior (distance traveled and velocity) were conducted at 5 dpf. The type I pyrethroids (bifenthrin and permethrin) and type II pyrethroids (esfenvalerate and lambda cyhalothrin), had significant ($p < 0.05$) behavioral effects on the zebrafish as compared to control. Type I pyrethroids demonstrated a U-shaped dose response with behavioral endpoints at 5 dpf, whereas type II pyrethroids showed no specific pattern in dose response with behavioral endpoints as compared to the control. The type I and II pyrethroids had significant effects on the expressions of certain genes (indicative of oxidative stress) in the zebrafish embryo-larval development. Further studies are being carried out to assess the physiological response of zebrafish exposed to the pyrethroids, as well as the stability of the pyrethroids.

***Platform 11***

Naveen Kumar, J. Crago
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**An Investigation of Off-Target Toxicity at Environmentally Relevant Concentrations of Fungicides Using an Embryo-Larval Zebrafish (*Danio rerio*) as a Model.** Current application of fungicides in cereals, fruits, and vegetables has led to adverse effects on aquatic ecosystem. Recent studies have shown a significant amount fungicide in streams, groundwater, and sediments. In the current study, we compared the off-target toxicity of two classes of fungicides (azole and strobilurin) using larval zebrafish (*Danio rerio*). The goal of this project was to relative fungicide toxicity using several behavioral endpoints and molecular biomarkers associated with their mode of action. Zebrafish embryos were exposed to fungicides (tebuconazole, propiconazole, myclobutanil, azoxystrobin, and pyraclostrobin) at different environmentally relevant concentrations, 10 ng/L, 100 ng/L, 10 µg/L, 100 µg/L and 1 mg/L, starting at 4 h post- fertilization (hpf) to 5 days post fertilization (dpf). All experiments were conducted according to an approved protocol from the Institutional Animal Care and Use Committee (IACUC), Texas Tech University. The behavior assays were conducted to examine swimming behavior (total distance and velocity) at 5 dpf using Danio Vision®. The stability of fungicides under experimental conditions were conducted and analyzed using LC-MS/MS. Gene expression, enzymatic assay, and mitochondrial dysfunction were measured to assess the relative toxicity amongst fungicides. The velocity and distance traveled by zebrafish larvae when exposed to triazole fungicides (tebuconazole, propiconazole, and myclobutanil) were not significantly different from the controls. However, in case of strobilurin chemical class, there was a significant decrease in the swimming behavior of the fish larvae. The molecular biomarkers indicate that strobilurin fungicides may cause oxidative stress and apoptosis at environmentally relevant concentrations. The results for the mitochondrial dysfunction are forthcoming.

***Platform 12***

Katherine M. Martin, E. A. Hasenmueller, J. R. White, L. G. Chambers, J. L. Conkle
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**Assessing Microplastics in the Mississippi River Watershed and Their Discharge to the Gulf of Mexico.** The ubiquitous presence of plastic debris in the ocean is recognized by the public and scientific communities. Most of this debris is considered microplastic (< 5 mm diameter) which due to their small size were not widely recognized until the last decade. While there are estimates for the total amount of plastic debris in the ocean, loading from many of the major sources have not been quantified. The Mississippi River is likely one of the largest sources of oceanic plastic debris in the U.S., and globally. This research funded by the NOAA Marine Debris Program will quantify and characterize (size, shape, resin type) microplastics within the main stem of the Mississippi River including major cities such as St. Louis and New Orleans as well as contributions from major tributaries (Missouri, Illinois and Ohio Rivers). Using the lowest total, quantified at the rivers highest stage, it was calculated that over 33 quadrillion suspect microplastics potentially reach the Gulf of Mexico per year by way of the Mississippi River. Quantification and analysis is ongoing, but the conclusive data will enable estimates of total microplastic loads and concentrations, spatial and temporal trends, land-use effects and total discharge of microplastics to the Gulf of Mexico. This research will produce a baseline that can be utilized in future research relating to the fate and effects of microplastics in aquatic environments as well as aid federal and local policy makers in creating and assessing mitigation strategies to improve water quality.

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***Poster 1***

Lihua Lou, J. Wang, Y. J. Lee, S. S. Ramkumar
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**Functional $TiO_2$/PVDF Nanofiber Webs for RhB Photocatalytic under Low-Energy Visible Light.** Visible light photocatalytic electrospun PVDF/$TiO_2$ nanofiber webs were produced in this study and their photocatalytic properties for the degradation of rhodamine B (RhB) aqueous solution were studied. Atomic force microscope (AFM), optical micrographs, water contact angle, fourier-transform infrared spectroscopy (FTIR), and UV-vis spectrophotometer spectrum were employed to study the morphology, structure, hydrophobicity, infrared spectrum, and optical properties of PVDF/$TiO_2$ nanofiber webs. The mechanical properties, the mechanism of fracture and RhB degradation of nanofiber webs were also studied. PVDF/$TiO_2$ nanofiber webs with a $TiO_2$ concentration of 20% were demonstrated to have best photocatalytic activity under visible light irradiation. This study may open a new opportunity to evaluate the catalytic properties of PVDF/$TiO_2$ nanofiber webs under low-energy visible light circumstance (simulated sunlight).

***Poster 2***

Grace Sutherland, M. E. Franco, R. Lavado
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**Use of Novel Cell-based Metabolomics Approach for Assessing Potential Toxicity of Seafood.** There has been significant research on the human health effects of persistent organic pollutants from fish consumption. However, with increasing levels of a wide variety of other compounds being measured in wild fish populations, there is little known about the risks these unknown or new compounds may pose. The proposed research objective is to improve our understanding of the potential hazards associated with human consumption of wild-caught Texas seafood. To model human dietary exposures, we will utilize two highly relevant human cell lines in a co-culture setup. The first is the intestinal Caco-2 cell line, and the second will be human HepaRG cells. Ingested chemicals generally first pass through the intestinal epithelium, a process that can include initial attempts to metabolize xenobiotics. This biotransformation can lead to the production of even more toxic metabolites. Once into the blood stream, most organic contaminants are metabolized in the liver. As a result, intestine and liver cells are often the most heavily damaged by ingested contaminants. The inclusion of the Caco-2 cell line in a co-culture approach provides a much more realistic chemical exposure for the HepaRG cell line, as relevant biotransformation that normally occurs in the human intestine will be represented. Following exposures, cells will be screened for cytotoxicity and a variety of toxicologically-relevant biochemical responses. To help identify unknown contaminant contributors of toxicological responses, samples will be screened for non-targeted analytes using GC/MS with electron ionization. Metabolomic analysis will identify 400 different metabolites, allowing for better understanding of chemical breakdown and cellular response. Identification of altered molecular pathways will signal significant mechanisms of toxicity and focus our efforts to determine which contaminants pose the greatest risks to human health.

***Poster 3***

Marco Franco, C. W. Matson, R. Lavado
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**Insights into the Xenobiotic Metabolism of Pollution-Adapted Gulf killifish (*Fundulus grandis*) Populations from the Houston Ship Channel, Texas, USA.** High concentrations of dioxin-like compounds, such as polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs), have been measured in the Houston Ship Channel (HSC), Texas, USA. However, the Gulf killifish (*Fundulus grandis*), a ubiquitous species inhabiting the HSC, has been recently characterized to be pollution-adapted. Previous studies in the sister species *Fundulus heteroclitus* have suggested that such adaptation is the result of reduced metabolism, mediated by the reduced activity of the aryl hydrocarbon receptor (AhR) pathway. In such case, the downregulation of CYP450 enzymes would decrease xenobiotic metabolism and the production of active metabolites, often with toxic properties. To obtain further insight into the biochemical mechanisms driving this adaptation, measurements of microsomal ethoxyresorufin-O-deethylase (EROD) activity were conducted in adult fish collected from heavily polluted and reference locations. In spite of large differences in exposure to AhR agonists, in

situ EROD activity was not significantly different among pollution-adapted and reference populations. Moreover, metabolic rates measured in fish embryos from reference, intermediate and heavily polluted sites after exposure to the PAHs benzo[a]pyrene, chrysene, and phenanthrene showed significantly lower metabolism in adapted populations. These observations suggest that xenobiotic metabolism pathways may indeed be reduced as a mechanism of resistance to high levels of industrial pollution, though further experimentation will be conducted by exposing adult fish to AhR agonists in the laboratory, by integrating in vivo and in vitro models, and by the characterization of metabolic profiles of known HSC contaminants in pollution-adapted Gulf killifish.

***Poster 4***

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**Neurobehavioral Effects of Organophosphates on Embryo-Larval Zebrafish at Environmentally Relevant Concentrations.** Organophosphates are common surface water contaminants in both urban and agricultural landscapes. Neurobehavioral effects on larval fish are known to occur at concentrations higher than those reported; however, behavioral effects have yet to be investigated at environmentally relevant concentrations. For this ongoing study, the developmental neurobehavioral effects of organophosphate exposure on embryo-larval zebrafish (*Danio rerio*) were assessed using a larval zebrafish behavior assay. Five common organophosphates (chlorpyrifos-oxon, methyl-parathion, malathion, dichlorvos, and diazinon) were assessed individually at environmentally relevant concentrations. Embryos were exposed to chlorpyrifos-oxon at 1 mg/L, which resulted in fatality of all embryos. Subsequent embryos were exposed to organophosphates at 100 µg/, 10 µg/L, 100 ng/L, and 10 ng/L starting at 4 h post-fertilization (hpf) to 5 d post-fertilization (dfp). Behavior assays assessing swimming behavior (distance traveled and velocity) were conducted at 5 dpf. Data was analyzed using one-way ANOVA with Tukey HSD post hoc test. Zebrafish larvae were tested individually at 100 µg/L chlorpyrifos-oxon ($p < 0.05$) and 100 µg/L diazinon ($p < 0.05$) and data revealed that zebrafish larvae traveled a significantly lesser distance than the controls. All chlorpyrifos-oxon treatment groups travelled lesser distance than the control group. Velocity of larva exposed to 100 µg/L chlorpyrifos-oxon and 100 µg/L diazinon decreased significantly compared to their control groups. Preliminary chlorpyrifos-oxon and diazinon data indicates behavioral changes at 100 µg/L in larva. All organophosphates displayed a decreasing trend in distance traveled and velocity relative to their controls. Acetylcholinesterase (AChE) activity will be assessed as investigation into organophosphates' neurobehavioral effects continues.

***Poster 5***

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**Exposure of Contaminants to Fauna and Flora in a Hyper-Arid Environment.** The Beatty, Nevada low-level radioactive waste (LLRW) site was established in 1962 and has since transitioned to US Ecology, Inc., a company responsible for the conversion of hazardous inorganic wastes to non-hazardous, delisted residues. Throughout the years, this site has been responsible for the storage and disposal of liquid radioactive waste, volatile organic compounds, and polychlorinated biphenyls (PCBs). In an effort to identify contaminant presence and movement from the immediate disposal site to the flora and fauna in the surrounding area, a study was developed to asses concentrations of per- and polyfluoroalkyl substances (PFAS), PCBs, various heavy metals, and tritium ($^{3}$H). To complete this assessment small mammals, insects, vegetation, and soil samples were collected from the area directly surrounding the LLRW site. Samples underwent analysis via LC-MS/MS, GC-MS, ICP-MS, and liquid scintillation spectroscopy depending on analyte of interest. Small mammal tissues showed varying concentrations of PFAS, PCBs, several heavy metals, and $^{3}$H. A restricted sample size of insects allowed for analyses of PFAS and PCBs which were both present at low concentrations. PCBs were the primary contaminant found in soil samples, with traces of PFAS and $^{3}$H. Little data were obtained from vegetation samples due to the complex matrix of the plant species (creosote). These data suggest that various anthropogenic contaminants may be moving from the LLRW to the surrounding areas but additional analyses are necessary to confirm this along with the pathways through which contaminants in this hyper-arid environment move.

***Poster 6***

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**Adaptation of Methods for the Immunofluorescent Visualization of Thyroxine (T4) in Larval Fathead Minnows (*Pimephales promelas*).** Thyroid disruption screening methods in larval fish often include the assessment of growth and thyroid-related gene expression. The direct measurement of thyroid hormones (THs) has also been employed via enzyme linked immunosorbent assays (ELISAs) and liquid chromatography mass spectrometry (LC/MS). However, ELISAs often require a large number of animals to be sacrificed and the pooling of tissues to achieve detectable levels of THs, whereas the utilization of LC/MS calls for expertise in analytical chemistry techniques. In contrast, the thyroxine-immunofluorescence quantitative disruption test (TIQDT), which allows for the fluorescent labeling of thyroxine (T4) within thyroid follicles, may be performed on individual fish and requires few specialized skills. As such, the goal of the current study was to adapt the TIQDT for use in the fathead minnow (*Pimephales promelas*), a commonly used fish model for aquatic toxicity testing including thyroid disruption. Fathead minnow larvae were exposed to either a low (25 mg/L) or high dose (70 mg/L) of the model thyroid suppressant, propylthiouracil (PTU), for 30 days beginning at < 24 hours post hatch. At 7 days post hatch (dph), a subset of larvae was sacrificed for the immunofluorescent labeling of T4. Each larva was imaged and integrated density (ID, a metric that

accounts for pixel density and area) of the thyroid follicles was measured. Relative to control larvae, 4.8 and 4.5-fold decreases in ID were observed in low and high dose PTU exposed larvae, respectively. In addition, significant reductions in growth were observed at 7 and 30 dph, and alterations in thyroid-related gene expression (*i.e. deiodinase 2 (di2)* and *transthyretin (ttr)*) were observed at 30 dph, further confirming the inhibition of T4 synthesis. The results of this study demonstrate that the TIQDT is a viable method for the assessment of T4 in larval fathead minnows.

***Poster 7***

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**Developing a Larval Fathead Minnow Screening Assay for the Detection of Thyroid Disrupting Compounds.** The fathead minnow (*Pimephales promelas*), a common model organism for assessing acute toxicity model, has recently been used to screen chemicals with suspected thyroid disrupting capabilities. However, because few studies have investigated the impacts of known thyroid disruptors on fathead minnows, appropriate methods for thyroid disruption screening using this species have yet to be developed. In an effort to develop an appropriate screening assay, this study sought to determine the sensitivity of thyroid responsive endpoints in this species at several time points throughout development. This was accomplished by exposing newly-hatched fathead minnows to various doses of propylthiouracil (PTU; a known thyroid disruptor) for 35 days, then evaluating growth, thyroid related gene expression, metrics, and pigmentation on day 7, 21, and 35. Significant reductions in growth metrics and pigmentations was seen on days 21 and 35, but not on day 7. Of the ten genes evaluated, deiodinase 2 (*di2*) was found to be responsive to PTU treatment at every sampling time; however, the induction of *di2* was highest on day 35. The results of this study that though signs of thyroid disruption can be detected following only 7 d of exposure, longer exposure periods may maximize the sensitivity of the assay, particularly, if growth is to be used as an endpoint. In addition, the study results show that thyroid-related gene expression, growth, and pigmentation are sufficient endpoints for detecting thyroid disruption in developing fathead minnows. The results of this study can be utilized to aid in the development of fathead minnow thyroid disruption screening assays.

***Poster 8***

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**Developing Methods for Assessment of Optomotor Response in Larval Fathead Minnows.** Alterations in neurological and/or eye development have been noted after exposures to a variety of environmental contaminants, including heavy metals, nanoparticles and polycyclic aromatic hydrocarbons. To adequately predict the impacts of environmental contaminants on neurodevelopment, toxicity testing methods must be refined to screen for such effects. One method utilized to evaluate vision in fish is the assessment of optomotor response (OMR), an instinctual

response in which a fish follows a moving reference point. To measure OMR, a fish is placed in an optomotor chamber surrounded by rotating black and white stripes and their ability to follow the stripes is recorded and evaluated. While there have been several OMR studies done utilizing other fish species, there are no established methods for an OMR assay utilizing fathead minnows, the species of choice for assessing the toxicity of environmental contaminants in the United States. The goal of this project was to develop methods for the assessment of OMR in larval fathead minnows. Factors such as at what age fish reliably exhibited OMR, the necessary acclimation time and the relationship between larval size and OMR were evaluated. The results of this project indicate that starting at 9 days post fertilization (dpf) larval fathead minnows exhibit detectable OMR and 4 min of acclimation to the chamber is needed. Interestingly, at 10 dpf there is no relationship between total length and OMR, but at 11 dpf size does play a role, suggesting that larval size should be taken into account in future studies with > 11 dpf fathead minnow larvae utilizing OMR as a metric. These results can be utilized by future researchers investigating the impact of toxicant exposure on neurological function in larval fathead minnows.

***Poster 9***

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**Probabilistic Aquatic Hazard Assessment of Anatoxin-a.** Cyanobacteria are highly versatile prokaryotes that are globally distributed in surface waters. Under proper conditions, cyanobacteria proliferate to form dense blooms capable of producing harmful secondary metabolites known as cyanotoxins, which present significant risks to human health and the environment through multiple exposure pathways. Notably the first described neurotoxic cyanotoxin, anatoxin-a, is a bicyclic secondary amine whose mechanism of action irreversibly binds to nicotinic acetylcholine receptors resulting in muscular paralysis and ultimately death by suffocation. Many studies have linked this toxin to dog, livestock, and avian deaths around areas of dense cyanobacterial blooms. With climate change serving as a forcing factor for these harmful algal blooms, such events are predicted to increase in magnitude, frequency and duration. In this study, we conducted a probabilistic aquatic hazard assessment, in which environmental exposure distributions of measured anatoxin-a concentrations from the peer-reviewed literature were developed to estimate the likelihood of exceeding guideline values (GV) in source waters. Only studies that had at least one positive detection for anatoxin-a were considered for the distributions. Anatoxin-a levels reported from strains taken from the environment and cultured in a laboratory setting were also not considered. Maximum anatoxin-a concentrations were used for probabilistic hazard determinations, based on consistencies in reported studies, and plotted against their Weibull ranking to determine threshold exceedances. The WHO GV for anatoxin-a concentration in drinking water (1 µg/L) was exceeded in 52.02% of cases, while the WHO GV for recreational waters (10 µg/L) was exceeded 23.85% of the time. Some locations have developed lower GVs for anatoxin-a. If Minnesota's GV, the lowest in the USA (0.1 µg/L), is considered then we observed a 79.18% exceedance frequency. Critical literature reviews and meta-analyses like the present effort can support problem formulation during environmental assessments to identify hot spots and data gaps for additional study.

***Poster 10***

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**Optimization of Mechanical Testing Parameters of PVA Nanofibrous Membranes.** In order to discover the relationship between the mechanical properties and testing parameters of PVA electrospun nanofibrous membranes, the tensile properties of PVA nanofiber membranes were measured with 3 different parameters: gauge length, cross-head speed, and membrane thickness. The tensile properties including results of extension at break (mm), Young's modulus (Mpa), maximum load (N), tensile stress at maximum load (Mpa), tenacity at break (gf/tex), and energy at break(J) were recorded and analyzed by polynomial regression, and contour plot and optimization analysis were employed to evaluate the effect of testing parameters on the tensile properties of membranes. According to the analysis of results, the optimal tensile testing parameters are: gauge length of 5 mm, cross-head speed of 5 mm/min, membrane thickness of 0.02 mm, and the parameters of significance in the effect on mechanical properties from maximum to minimum are: membrane thickness, cross-head speed and then gauge length. The $R^2$ of polynomial regression equations for membrane mechanical properties is about 0.7.

***Poster 11***

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**Presence of Microplastic Fibers in Highly Trafficked Public Areas of Academic Buildings.** Plastic polymers are one of the main textiles used for clothes today and much like natural materials, they also shed fibers during normal use. Therefore, these fibers are regularly found in the environment, where their presence in aquatic systems has received significant attention. However, human contact with these fibers is likely to be the most common in our homes and places of work, which has received much less attention to date. This preliminary study aimed to assess the presence of fibers (natural and synthetic) in two Texas A&M University Corpus Christi buildings with high foot traffic. Fiber traps (membrane filters) were set in high traffic areas of the first and second floors of the Center for Instruction and in the Classroom West building, where they were collected and replaced on a weekly basis for six months. The traps were then examined under a microscope and suspected fibers were sorted and saved. The suspected fibers were subsampled and analyzed using Fourier Transform Infrared spectroscopy analysis (FTIR) to determine material type (polymer, natural, etc.). The data gathered provides information on the amount and characteristics of fibers shed from clothing. While only an ongoing preliminary study, we expect that the amount of fibers collected to be related to human traffic occurring near the sampling locations. The FTIR data will help to identify polymer types, with the goal of assessing fabrics worn by students that shed the most fibers. Last, these fibers are present in the air around, representing a potential inhalation or ingestion hazard. While this study will not address these hazards, it will provide some baseline data on environmental presence that can be used to develop future studies.

***Poster 12***

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**Development and Validation of a Muti-Drug Analysis in White-Tailed Deer (*Odocoileus virginianus*) by Liquid Chromatography-Tandem Mass Spectrometry.** In agricultural practice, antibiotics are generally used for chemotherapeutic and prophylactic purposes, as well as feed additives to promote growth and improve feed efficiency. This practice is commonly utilized in the commercial deer breeding industry. To minimize handling of the animals, multiple husbandry procedures are accomplished at the same time. As a result, there is the possibility that, when multiple drugs are administered, multiple drug residues may occur in animal tissues for consumption. To extract and analyze multi-drug residues individually is both time consuming and costly. In an effort to minimize the cost associated with residue analysis and reduce the time to obtain drug residue results, we have developed and validated a multi-drug UHPLC-MS/MS method for screening and confirmation of four veterinary drugs used in white-tailed deer in accordance with FDA guidelines. The method described is a quick, easy, cheap, effective, rugged, and safe (QuEChERs) extraction procedure using acetonitrile and 0.1% formic acid. The supernatant was evaporated and reconstituted with 1 mL of methanol, then PSA and $C_{18}$ sorbents were added. The final extracts were filtered and analyzed using UHPLC-MS/MS on a Kinetex $C_{18}$ column using gradient elution. The recovery percentage for liver, kidney, and muscle samples ranged between 47%-155%, 43%-131%, and 50%-180% respectively. The limit of detection ranged between 0.3 and 1.1 ng/g, while the limit of quantification ranged 1.0 - 3.80 ng/g. Repeatability for liver, kidney, and muscle ranged 6%-46%, 4%-38.6%, and 7%-68%, respectively.

***Poster 13***

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**Methylmercury Contamination in Terrestrial Spiders along the Trinity River, Fort Worth, Texas.** Methylmercury (MeHg) is a toxic environmental contaminant found in all waterbodies on Earth. Aquatic emergent insects, such as mosquitoes and midges, can transfer MeHg from waterbodies to terrestrial ecosystems. Terrestrial shoreline spiders consume aquatic emergent insects and become contaminated with MeHg. Methylmercury-contaminated spiders can pose a risk to songbirds that consume terrestrial spiders. Because shoreline spiders have MeHg concentrations that reflect MeHg contamination of nearby aquatic ecosystems and are an important source of MeHg to songbirds, they have been proposed as a biosentinel species that can be used to estimate MeHg contamination of waterbodies. In this study, I used long-jawed orb weavers (Tetragnatha sp.) as a biosentinel species to examine MeHg contamination along the Clear Fork and the West Fork of the Trinity River, Fort Worth, Texas. The objectives of this study were to: 1) evaluate MeHg contamination in long-jawed orb weavers from two forks of the Trinity River, and 2) evaluate if the concentrations of MeHg in the spiders pose a risk to songbirds that feed on spiders. I collected 101 and 105 spiders along the Clear Fork and the West Fork, respectively. I used a Direct Mercury Analyzer to determine the total Hg

concentration of the long-jawed orb weavers. Because MeHg is the primary species of mercury in spider tissues, I used total Hg as a proxy for MeHg. All spiders were contaminated with MeHg, with spiders along the Clear Fork having significantly higher MeHg concentrations than spiders along the West Fork. Methylmercury in spiders increased with spider size along the Clear Fork. Concentrations of MeHg in spiders along the Clear Fork and the West Fork were high enough to pose a risk to the physiology of nestling songbirds that feed on spiders.

***Poster 14***

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**Assessment of the Transcriptome in Tree Swallow (*Tachycineta bicolor*) Nestlings from Great Lakes Areas of Concern.** Polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated dibenzo-p-dioxins and dibenzo-furans (PCDD/PCDFs), and a variety of pesticides and other contaminants of emerging concern (CECs) are significant issues in Areas of Concern (AOC) on the Great Lakes. Pharmaceuticals and personal care products have become major CECs with limited knowledge of the effects of dietary exposure to terrestrial animals. Tree swallow (*Tachycineta bicolor*) nestlings were collected from 27 AOCs and nine nearby non-AOC sites from 2010 to 2015. Contaminant analyses and biomarkers were examined in all nestlings collected. In 2016, nestlings were collected from six locations on the Maumee River to evaluate CECs, including pharmaceuticals and personal care products. Transcriptomic responses were evaluated in nestlings collected from selected sites on the Great Lakes and the Maumee River. RNA-Seq library construction and sequencing were done with Illumina chemistries. De novo assembly and downstream differential gene expression (DGE) analyses were utilized the Trinity platform and its suggested workflow. We found that differential gene expression was correlated with geological location for the samples collected over the entire Great Lakes area and for those collected from the Maumee River. Biomarkers of DNA damage, cytochrome P450 1A activity were found to correlate with DGE. However, downstream pathway analysis was restricted by the quality of the de novo assembly. Multiple assembling methods were tested to improve completeness and mapping rate. We found that using multiple assemblers and then cleaning it up with EvidentialGene decreased the total number of duplicated or fragmented transcripts and improved the completeness of the assembly based on BUSCO scores.

# Notes

**2018 Regional Meeting Program Committee**

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